Amendments to the Claims

Please cancel Claims 12, 16-18 and 30. Please amend Claims 1-5, 8-11, 13-15, 19-29 and 31-41. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1. (Currently amended) A variable-impedance active ankle foot orthosis comprising:

a) an actuator configured to support a human ankle joint;

b) at least one of an ankle angle sensor and a ground reaction force sensor; and

c) a computer controller linked to the actuator and the sensor, the computer controller configured to modulate, in an updating manner, impedance of the actuator in response to at least one signal from the sensor, thereby modulating ~~modulates~~, by computer-controlled actuation, impedance of the human ankle joint, including a joint stiffness or damping of [[an]] the ankle joint, in an updating manner ~~at least three times during each~~ from step-to-step of a walk cycle for treating an ankle foot gait pathology.

2. (Currently amended) The device of Claim 1, wherein the ~~device includes an~~ actuator ~~that modulates the joint stiffness of~~ includes a torsional spring control component that modulates impedance of the ankle joint.

3. (Currently amended) The device of Claim 1, wherein the ~~device includes an~~ actuator ~~that modulates the joint stiffness or damping of~~ includes a spring-damper control component that modulates impedance of the ankle joint.

4. (Currently amended) The device of Claim 1, wherein the orthosis further includes a foot portion and wherein the ~~device includes an~~ actuator ~~that~~ is coupled to [[a]] the foot portion of the orthosis.

5. (Currently amended) The device of Claim 1, wherein the ~~device includes an~~ actuator ~~that~~ is a series elastic actuator.

6. (Previously presented) The device of Claim 1, wherein the orthosis includes an ankle angle sensor.

7. (Previously presented) The device of Claim 1, wherein the orthosis includes one or more ground reaction force sensors.

8. (Currently amended) The device of Claim 1, wherein the orthosis includes ~~an actuator,~~ an ankle angle sensor[[,]] and one or more ground reaction force sensors~~, and a controller for controlling the orthosis~~.

9. (Currently amended) The device of Claim [[1]]4, wherein the orthosis further includes a foot switch at the foot portion that is connected to the computer controller.

10. (Currently amended) The device of Claim 1, wherein the ~~orthosis is used~~ controller is programmed to treat drop foot gait.

11. (Currently amended) The device of Claim 1, wherein the ~~orthosis is used~~ controller is programmed to treat a patient having anterior muscle weakness, posterior muscle weakness, or a combination thereof.

12. (Cancelled)

13. (Currently amended) The device of Claim [[12]] 1, wherein the ~~actuator adjusts stiffness of the ankle joint by controlling the spring deflection during controlled plantar flexion~~ controller is programmed to minimize forefoot collisions ~~with the ground~~ from step-to-step of the walk cycle.

14. (Currently amended) The device of Claim [[12]]1, wherein the ~~actuator~~ controller is programmed to minimize[[s]] ~~the~~ ankle joint stiffness or damping during a late stance portion of the step-to-step walk cycle.

15. (Currently amended) The device of Claim [[12]]1, wherein the ~~actuator~~ controller is programmed to modulate[[s]] ~~the~~ ankle joint stiffness or damping of a spring-damper control during a swing phase portion of the step-to-step walk cycle.

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Currently amended) A method comprising the step of modulating, by computer-controlled actuation, impedance, including joint stiffness or damping, of an ankle joint in an updating manner ~~at least three times during each~~ from step-to-step of a walk[[ing]] cycle, in response to at least one of an ankle angle sensor and a ground force reaction sensor, by modulating an actuator connected to the ankle joint.

20. (Currently amended) The method of Claim 19, wherein the step of modulating the joint stiffness or damping of the ankle joint during walking further includes ~~adjusting~~ modulating the ankle joint stiffness during controlled plantar flexion of the ankle joint, ~~to minimize~~ whereby forefoot collisions with the ground from step-to-step of the walk cycle are modulated.

21. (Currently amended) The method of Claim 20, wherein the stiffness of the ankle joint is ~~adjusted~~ modulated by ~~use of a torsional~~ modulating force applied to a spring ~~control~~ that controls impedance of the ankle joint.

22. (Currently amended) The method of Claim 19, further comprising ~~minimizing~~ modulating the joint stiffness or damping during a late stance portion of the step-to-step walk cycle.

23. (Currently amended) The method of Claim 19, wherein the step of modulating the joint stiffness or damping of the ankle joint during walking further comprises modulating ankle joint stiffness, or damping, or both of a torsional spring-damper control during a swing phase portion of a step-to-step walk cycle.

24. (Currently amended) A method of treating an ankle foot gait pathology using functional electrical stimulation, comprising the step of:

applying computer-controlled electrical pulses in response to at least one of an ankle angle sensor and a ground force reaction sensor, to elicit muscle contractions of a human ankle joint to actively modulate impedance, including ankle stiffness, or damping, or both during walking, wherein joint stiffness or damping or both is modulated in an updating manner ~~at least three times during each~~ from step-to-step of a walk[[ing]] cycle.

25. (Currently amended) A variable-impedance active ankle foot orthosis, comprising:

~~a computer-controlled actuator and a spring operatively linked to the actuator,~~

a) an actuator that includes a spring, wherein he actuator is configured to support a human ankle joint;

b) at least one of an ankle angle and ground reaction force sensor; and

c) a computer controller linked to the actuator and the sensor, the actuator configured to modulate impedance, including ~~modulating~~ a joint stiffness or damping of an ankle joint, by controlling [[a]] compression of the spring ~~compression~~ in response to ~~at least two sensed parameters~~ at least one of ankle angle and ground reaction force~~during walking~~, the actuator modulating the joint stiffness or damping of the ankle joint by controlling the spring ~~in at least two different modulation phases~~ in an updating manner ~~at least three times during [[each]]~~ from step-to-step of a walk[[ing]] cycle in response to ~~at least two sensed parameters~~ at least one of ankle angle and ground reaction force.

26. (Currently amended) The variable-impedance active ankle foot orthosis of Claim 1, wherein the device further includes a spring linked to [[an]] the actuator, ~~wherein~~ whereby the actuator is configured to modulate[[s]] the joint stiffness or damping of the ankle joint.

27. (Currently amended) The variable-impedance active ankle foot orthosis of Claim 26, further including a torsional spring control wherein the actuator is configured to modulate[[s]] the joint stiffness of the ankle joint by controlling stiffness of [[a]] the torsional spring control.

28. (Currently amended) The variable-impedance active ankle foot orthosis of Claim 27, further including a torsional spring-damper control, wherein the actuator is configured to modulate[[s]] the damping of the ankle joint by controlling damping of [[a]] the torsional spring-damper control.

29. (Currently amended) The method of Claim 19, further including the steps of operatively coupling a spring to an orthosis, [[and]] sensing ~~one or more parameters of the orthosis~~ at least one of ankle angle and ground reaction force during walking, and modulating the ankle joint impedance by controlling the spring in response to the ankle angle or ground reaction force.

30. (Canceled)

31. (Currently amended) A method of treating an ankle foot gait pathology using functional electrical stimulation, comprising the step of:

applying computer-controlled electrical pulses, in response to at least one of an ankle angle sensor and a ground force reaction sensor, to elicit muscle contractions of a human ankle joint to actively modulate impedance, including ankle stiffness, or, damping, or both in an updating manner ~~at least three times during each~~ from step-to-step

of a walking cycle, the joint stiffness or damping further being modulated by controlling a spring ~~associated with~~ connected to an orthosis supporting the human ankle joint.

32. (Currently amended) The method of Claim 19, ~~further including the steps of operatively receiving a parameter of a forefoot force~~ wherein the modulation is in response to a ground reaction force sensor signal during walking ~~and modulating the joint stiffness or damping of the ankle joint in response to the parameter~~.

33. (Currently amended) The method of Claim 24, wherein the electrical pulses actively modulate stiffness of the ankle [[stiffness]] during a stance period.

34. (Currently amended) The method of Claim 24, wherein the electrical pulses actively modulate stiffness of the ankle ~~stiffness of a torsional spring control~~ joint.

35. (Currently amended) The method of Claim 24, wherein the electrical pulses actively modulate at least one of ankle joint stiffness or damping during a swing phase.

36. (Currently amended) The method of Claim 24, wherein the electrical pulses actively modulate at least one of ankle joint stiffness or damping of a spring damper control of the actuator during a swing phase of the walk cycle.

37. (Currently amended) A variable impedance active ankle foot orthosis comprising:

a) an actuator configured to support a human ankle joint;

b) at least one of a ground reaction force sensor and an ankle angle sensor; and

c) a computer controller linked to the actuator and to the sensor,

~~a device that~~ wherein the orthosis is configured to modulate[[s]], by computer-controlled actuation, ankle joint impedance, including a joint stiffness or damping of an ankle joint, wherein modulation of the joint impedance is adaptive in nature~~, whereby~~

~~information from each gait cycle causes further modulations that vary joint impedance from one gait cycle to the next~~.

38. (Currently amended) A device for treating an ankle foot gait pathology comprising:

an orthosis including an orthosis leg portion attachable to a leg of a person and an orthosis foot portion attachable to a foot of the person; and

an actuator configured to act on a spring;

at least one of an ankle angle sensor and a ground reaction force sensor; and

a computer controller linked to the actuator and the sensor, the computer controller configured to modulate ~~to modulate,~~ by computer-controlled actuation, impedance, including joint stiffness or damping of the ankle joint, wherein modulation of joint impedance is adaptive in nature~~, whereby information from each gait cycle causes further modulations that vary joint impedance from one gait cycle to the next~~.

39. (Currently amended) A method comprising modulating, by computer-controlled actuation, impedance, including joint stiffness or damping of an ankle joint wherein modulation of joint impedance is adaptive in nature and in response to at least one of an ankle angle sensor and a ground force reaction sensor, and wherein the actuator is an actuator that is connected to an orthosis that supports an ankle joint~~, whereby information from each gait cycle causes further modulations that vary joint impedance from one gait cycle to the next~~.

40. (Currently amended) A variable impedance active ankle foot orthosis comprising:

a) an actuator and a spring operatively linked to the actuator[[,]]

b) an ankle angle sensor;

c) a ground force reaction sensor; and

d) a controller linked to the sensors and to the actuator, wherein the actuator is configured to ~~modulating~~modulate, by computer-controlled actuation, impedance, including a joint stiffness or damping of an ankle joint, by controlling ~~a spring compression~~ compression of the spring, in response to ~~at least two sensed~~

~~parameters~~ the two sensors during walking, the actuator modulating the joint stiffness or damping of the ankle joint, ~~by controlling the spring in at least two different modulation phases~~ wherein modulation of joint impedance is adaptive in nature~~, whereby information from each gait cycle causes further modulations that vary joint impedance from one gait cycle to the next~~.

41. (Currently amended) A method of treating an ankle foot gait pathology using functional electrical stimulation, comprising the steps of:

applying electrical pulses to elicit muscle contractions to actively modulate, by computer-controlled actuation, impedance, including ankle joint stiffness[[,]] or[[,]] damping, or both, of an ankle joint, wherein modulation of joint impedance is adaptive in nature, the modulation being in response to at least one of an ankle angle sensor or a ground reaction force sensor, ~~whereby information from each gait cycle causes further modulations that vary joint impedance from one gait cycle to the next~~.

the joint stiffness or damping further being modulated by controlling a spring ~~associated with an~~ linked to an orthosis that is supporting the ankle joint.